PATENT SPECIFICATION

DRAWINGS ATTACHED

862,659

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International Classification:— B27b, F02b, F06c, d.

COMPLETE SPECIFICATION

Crank-Shaft Arrangement for Internal Combustion Engines

I, BIRGIT ANNA MARIA BACKLUND, nee Larson, a Swedish Subject, of Artillerigatan 63, Stockholm, Sweden, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to crank-shaft arrangements for internal combustion engines.

It is particularly applicable to small machine units such as might be used for example in portable tree-felling motor-saws and the like.

The main aim of the present invention is to improve the driving arrangements of such units, but the invention can be applied to advantage also to other types of machine units in which problems similar to those encountered in portable motor-saws of power transmission occur. To simplify what follows, however, the invention will be described with reference to its application to engines for portable motor-saws.

There are two very important requirements in a portable saw driven by an internal combustion engine. They are, firstly, that the machine must be as light as possible and, secondly, that the machine must have so rigid a construction that it can withstand without damage the abnormally strong loads which frequently occur when cutting through comparatively thick tree trunks. These requirements are in a way conflicting especially as regards the means for transmission of power from the crank shaft to the sprocket wheel which drives the saw-chain in the so-called "saw sword". A compromise of the two is the obvious solution and endeavours have been made in all constructions hitherto known to solve the problem in this way. The result of all these attempts at a compromise has generally been that neither of the two requirements has been met in a satisfactory manner. In general, the strength of the apparatus has been reduced in order to make it light with the result that abnormally high repairing costs have been necessary.

The invention aims to fulfil both the said main requirements without any compromise.

The invention relates to an internal combustion engine shaft arrangement wherein the crank-shaft is supported in bearings on either side and close to the crank and wherein the shaft on at least one side of the crank is axially bored and has journalled within it a take-off shaft which carries means for transmitting the crank-shaft drive. The driving connection between the crank-shaft and the take-off shaft is by way of a centrifugally operated clutch and the take-off shaft is journalled in the crank-case as well as in the crank-shaft.

Preferably the centrifugally operated clutch has a driving section mounted on the crank-shaft which comprises weights mounted so as to be displaceable radially under centrifugal force at a predetermined crank-shaft speed to engage with a friction surface on a driven section mounted on the take-off shaft. Springs are associated with the weights which have the effect of tending to counteract the outward movement of the weights.

On account of the rigid construction of the driving unit this power transmission means will be resistive to the reaction forces which in operation act in a plane at right angles to the axial direction of the unit. Operative parts of the engine, such as the fly-wheel, starting apparatus and driving means for the ignition appliance may be connected to the other crank pin or crank shaft section at the opposite side of the crank web but the fly-wheel may also be combined with the friction clutch and attached to its driving section.

Preferably, the friction clutch is enclosed in a dust-tight manner in the stationary part (the casing) of the engine. It is preferred to use bearings of the ball type, the roller bearing type or the needle type which show a permanent, minimum radial play.

In order to facilitate understanding of the invention two embodiments of it will now be

described with reference to the accompanying drawings in which:

Fig. 1 illustrates diagrammatically part of the crank-shaft section of an engine of a typical known construction for portable motor-saws with single-cylinder engine and direct-driven saw-chain;

Fig. 2 illustrates, in axial section, one embodiment of a construction according to the invention;

Fig. 3 is a modified embodiment according to the invention; and

Fig. 4 is an end view of the clutch unit of Fig. 3.

In Fig. 1 the crank-shaft of a known single-cylinder two-stroke engine is shown at 1 and 11 on both sides of the crank web 1*a*. An engine fly-wheel 2 acts as a cooling air fan and forms part of the ignition magneto of so-called flywheel type. Packings 3 are provided for preventing oil leakage. The crank-shaft is journalled in bearings 4, 5 mounted in the crank-case. Rigidly attached to the crank-shaft is a hub 6 for the driving part of a centrifugal clutch 7 of the friction type, the driven part of which comprises a drum 8. The clutch 7, 8 is adapted to be engaged at an engine speed below a predetermined value and begins to be automatically connected at this value and is fully engaged at a somewhat higher speed. A driven sprocket wheel 9 or toothed wheel is keyed to the hub of the drum 8 so as to rotate together with the latter, the sprocket-wheel being journalled to rotate on a bearing 10 of intermediate shaft 11. The saw-chain (not shown) is driven by the sprocket-wheel 9.

As will be seen from Fig. 1 the crank-shaft 1, 11 (having a length of 220 mm. for instance) is journalled only in the bearings 4 and 5 which are placed relatively close together, and the forces from the saw-chain acting on the sprocket-wheel 9 have a considerable torque arm or moment arm (60 mm. length) to the nearest bearing 5. Since the crank-shaft is made rather slender in order to keep the weight of the apparatus low the construction will as a result be particularly frail and unsuitable. In order not to extend the torque arm or moment arm of the driving stub shaft further there is left no space to enclose the centrifugal clutch and since the clutch is arranged at a place where streams of saw-dust and such like are flowing, dirt will easily penetrate into the clutch and have a detrimental effect on its operation and durability. Practical experience in operation has unanimously confirmed that the above criticism is justified.

Fig. 2 shows how the present invention may be applied to a portable motor-saw driven by a similar engine of practically the same size as that shown in Fig. 1 (dimension of cylinder may, for instance, be 55 x 40 mm. as compared with 54 x 38 mm. in Fig. 1). Similar parts in Figures 1 and 2 have been indicated by the same reference characters.

Crank-shaft 1 in Fig. 2 according to the invention has a considerably larger diameter than the shaft in Fig. 1, but in order to reduce the weight the shaft has co-axial cylindrical borings of as great a diameter as possible without causing any deterioration of the function. Thus, the crank-shaft is light but nevertheless very rigid and can be provided with large ball bearings with practically unlimited longevity. It will be seen that the shaft is very short. The shaft portion situated on the driving side of the crank web 1*a* is not used as a shaft for the driving sprocket-wheel 9 but merely for the driving part of the hub 6 of the centrifugal clutch 7. As shaft for driving sprocket-wheel 9 and the driven part 8 of the clutch and its associated hub there is arranged a separate pin or shaft 11*a*. This shaft 11*a* is journalled to rotate in a bearing 10 in the cylindrical boring of the crank-shaft, and also in ball bearing 12 in the stationary part or casing of the engine. In this way a construction is obtained having a torque arm or moment arm of only 22 mm.—as compared with 60 mm. in the engine according to Fig. 1—and with a very great resistivity to bending stresses and transverse forces but nevertheless in the arrangement according to the present invention there is plenty of room for arranging a dust-proof enclosure of the clutch 7, 8 and thus protect it against flying saw-dust and such like. Shaft 11*a* can, of course, if desired, be bored so as to enable lubrication of bearing 10.

The construction of the centrifugal clutch will be shown more in detail in Figs. 3 and 4.

Preferably, the engine should be equipped with a light ignition magneto mounted in the stationary part of the engine and adapted to be driven by a toothed belt from a special toothed wheel 13, rigidly secured to the hub of the flywheel 2.

Calculations show that a driving arrangement according to Fig. 2 will give a saving in weight of nearly 2 kg. and increase the longevity many times (as compared with the arrangement of Fig. 1).

Figs. 3 and 4 show a modified embodiment in which the fly-wheel 2*a* has been combined with the centrifugal clutch. The fly-wheel 2*a* is rigidly secured to the hollow crank-shaft section 1 by means of a key 2*b*. The fly-wheel carries a number of lateral bolts 7*c* extending through elongated holes or slots 7*d* in two weights 7*a* which thus are free to move outwardly radially to a limited extent. The weights 7*a* are rotated together with the fly-wheel 2*a* and form the driving section of the centrifugal clutch while the driven section comprises the drum 8 having a hub 8*b* rigidly attached to shaft 11*a* so as to drive the latter when the rotating weights 7*a* engage the drum 8. The outward movement of the weights is caused by the centrifugal f rce at a predetermined speed of rotation against the action of spring means 18 (Fig. 4) which inter-connect

the weights and tend to draw them into their inner position. On moving outwardly the weights 7*a* will engage the inner surface of the drum so as to drive the latter and thus also the shaft 11*a* and the sprocket wheel 9.

A nut 17 screwed on threads at the end of the hollow shaft 1 may be provided to prevent the fly-wheel 2*a* from loosening.

Fig. 3 also shows the bearing 4*a* for the connecting rod in the crank web 1*a*. Casings 14 and 15 are provided for the crank mechanism and the centrifugal clutch respectively. A further casing 16 may be provided for the fly-wheel 2 in Fig. 2.

The invention may, of course, also be applied to other appliances than chain-saws. Also the left-hand and lower crank-shaft sections may be hollow as shown in Figs. 2 and 3 respectively.

Operative parts of the engine, such as driving means for the ignition apparatus and the starting means, may be associated with the lower crank-shaft section 1 in Fig. 3.

WHAT I CLAIM IS:—

1. A crank-shaft arrangement for internal combustion engines wherein the crank-shaft is supported in bearings at either side and close to a crank proper and wherein the shaft on at least one side of the crank is axially bored and has journalled in it and projecting from the end, a take-off shaft also journalled in a stationary journal, which carries means for transmitting the crank-shaft drive, the driving connection between the crank-shaft and the take-off shaft being through a centrifugally operated clutch.

2. A crank-shaft arrangement according to claim 1 wherein the centrifugally operated clutch has a driving section mounted on the crank-shaft which comprises weights mounted so as to be displaceable radially under centrifugal force at a predetermined crank-shaft speed to engage with a friction surface on a driven section mounted on the take-off shaft and springs associated with the weights so as to counteract their outward moving tendency.

3. A crank-shaft arrangement according to claim 1 or claim 2 wherein the centrifugally operated clutch is enclosed in a stationary casing and the take-off shaft extends through the casing.

4. A crank-shaft arrangement according to any preceding claim wherein operative means of the engine, such as a fly-wheel, are associated with the crank-shaft section on the opposite side of the crank to the bored end.

5. A crank-shaft arrangement according to any of preceding claims 1 to 3 wherein a fly-wheel is combined with the centrifugal clutch and is arranged as part of the driving section thereof.

6. A crank-shaft arrangement according to claim 5 wherein the fly-wheel carries guiding projections which engage guiding slots in centrifugally movable weights which operate the clutch.

7. A crank-shaft arrangement substantially as described herein with reference to Fig. 2 or Figs. 3 and 4 of the accompanying drawings.

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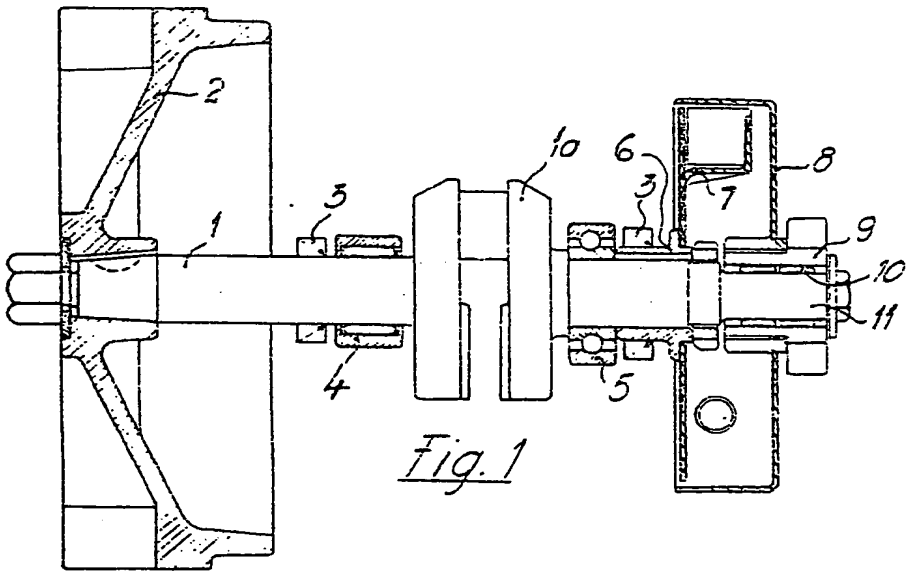

Fig. 1

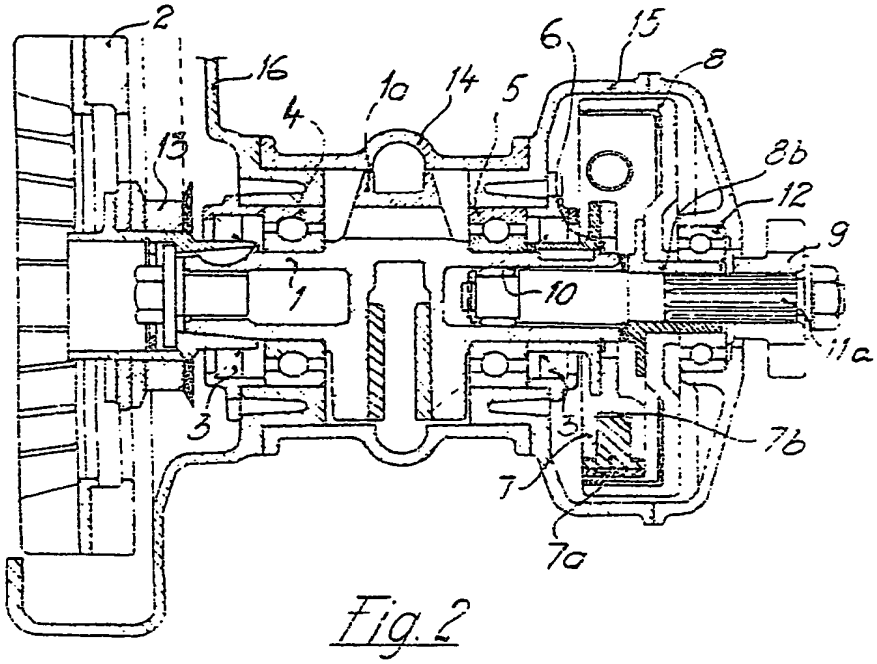

Fig. 2

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2 SHEETS

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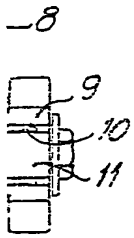
SHEETS 1 & 2



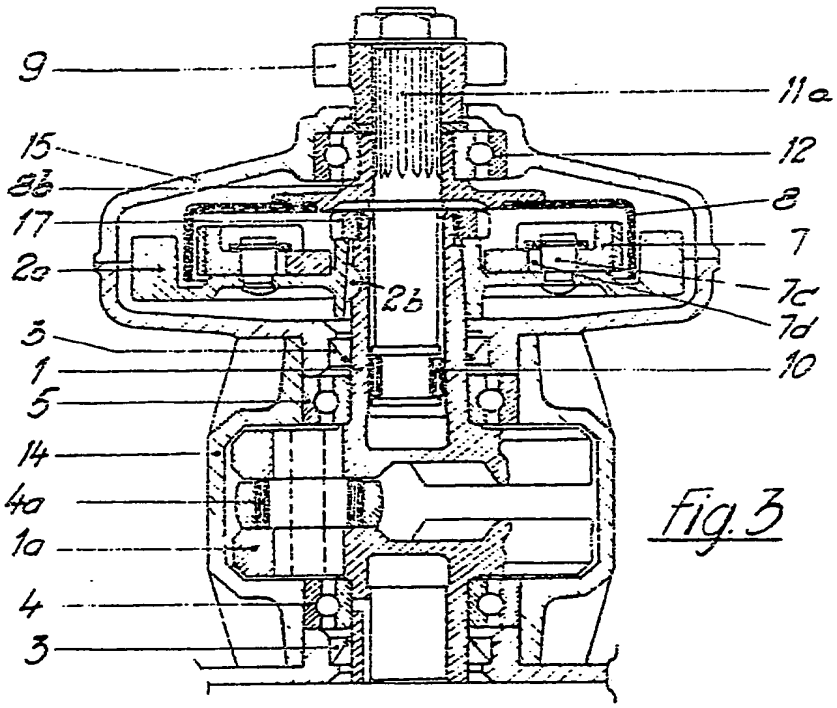
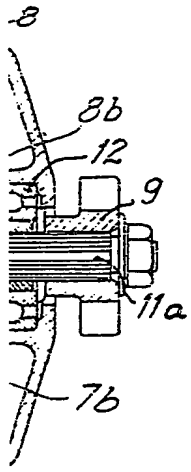


Fig. 3



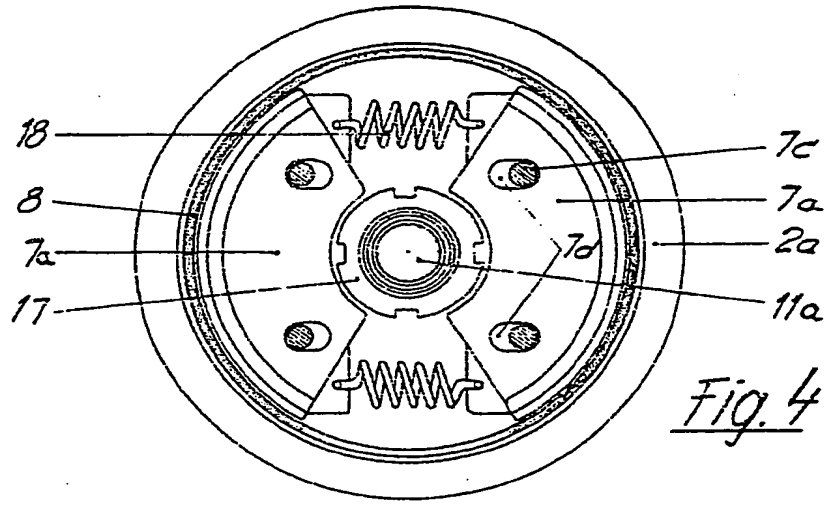


Fig. 4

862,659 COMPLETE SPECIFICATION

2 SHEETS

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SHEETS 1 & 2

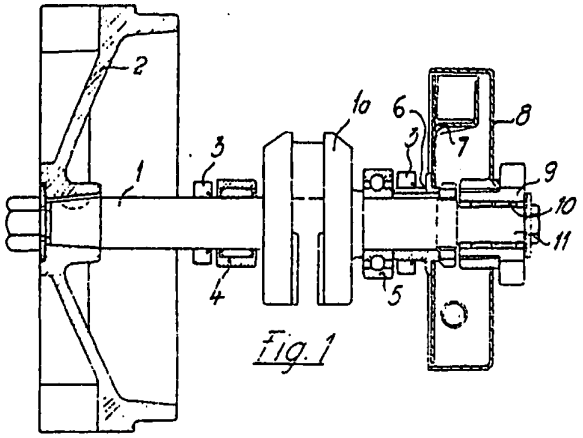

Fig. 1

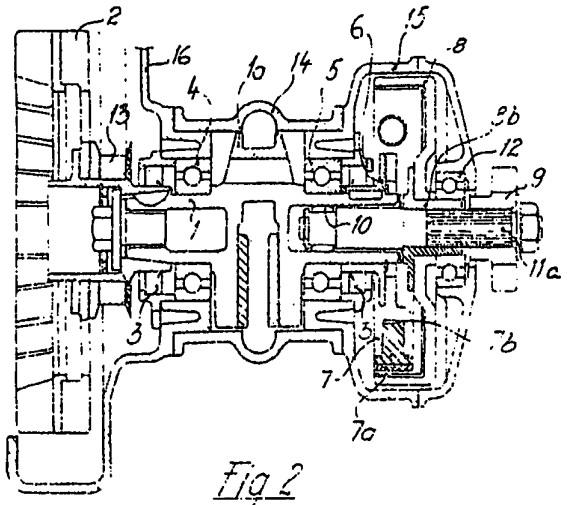

Fig 2

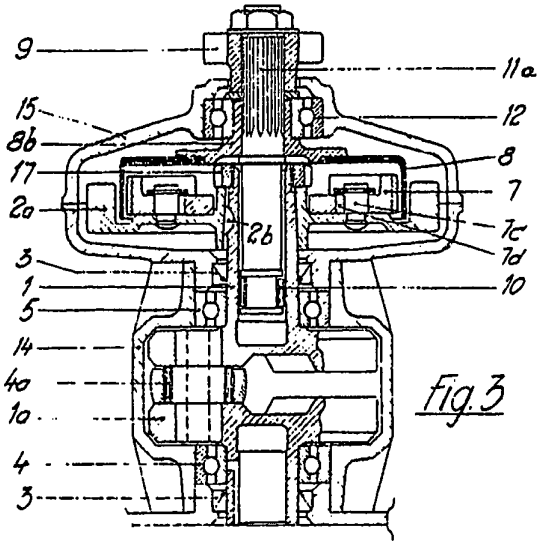

Fig. 3

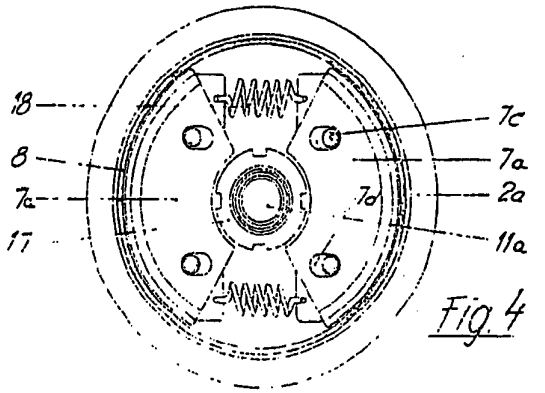

Fig. 4